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An updated database of focal mechanism solutions and stress estimation for the Calabrian Arc region (south Italy)

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An updated high-quality database of 444 focal mechanisms relative to crustal earthquakes that occurred in the Calabrian Arc region (south Italy) between January 1977 and October 2015 has been compiled. Since is widely shared that waveform inversion solutions are better constrained than P-onset polarity inversion ones, we selected from literature and catalogues the highest quality waveform inversion solutions available and also added 146 solutions newly-computed in the present study.
All the selected focal mechanisms are (i) coming from the Italian CMT, Regional CMT and TDMT catalogues [http://www.bo.ingv.it/RCMT; http://www.bo.ingv.it/RCMT/Italydataset.html; http://cnt.rm.ingv.it/tdmt.html], or (ii) computed by using the Cut And Paste (CAP) method. In the CAP technique, each waveform is broken up into Pnl and surface wave segments, which are weighted differently during the inversion procedure. In the present study, this method has been applied to earthquakes having $M \geq 2.6$ that occurred at depths shallower than 40 km in the study region between January 2006 and October 2015. The robustness of the obtained results has been verified through specific tests by varying both seismic network configuration and Earth structure parameters, as well as by modifying earthquake focal depths and locations. Then, only the resulting highest-quality solutions having errors on fault parameters lower than 10° have been enclosed in the database. The integration of earthquake focal mechanisms determined using the CAP method has made it possible to expand the database of focal mechanisms down to a minimum of magnitude 2.6 without overlooking the reliability of results.
The so obtained database has been used to perform stress inversion analyses by applying, for the first time in southern Italy, a Bayesian method furnishing the posterior density function of the principal components of stress tensor and the stress-magnitude ratio. The large amount of data and the Bayesian algorithm allowed us to provide a detailed picture of seismotectonic stress regimes acting in this very complex area where lithospheric unit configuration and geodynamic engines are still strongly debated. The new high-quality information here furnished will also represent very useful tools and constraints for future geophysical analyses and geodynamic modeling.